

A NEW GENUS OF MICROVELIINAE FROM TREEHOLES IN KENYA (HETEROPTERA: VELIIDAE)

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Cylicovelina kenya gen. n., sp. n. is described from water-filled treeholes in Kenya.

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Key words. – Heteroptera, Veliidae, *Cylicovelina*, taxonomy, new genus, new species, phytotelmata, Kenya.

Although a number of veliid species are known from container habitats in the New World, few have been recorded from the Old World. Throughout the American tropics terrestrial and arboreal bromeliads with water pockets harbor a guild of veliid species endemic to them (reviewed by Polhemus & Polhemus 1991), belonging to the genera *Paravelia* Breddin and *Microvelia* Westwood. In addition, *Paravelia myersi* (Hungerford) is known from treeholes in Trinidad (Hungerford 1931) and Panama (Polhemus & Yanoviak in prep.), an undescribed species of *Microvelia* from treeholes in Panama (Polhemus & Yanoviak in prep.), and two species of *Microvelia* from crabholes in Costa Rica (Polhemus & Hogue 1972). Of these two genera only *Microvelia* occurs in the Old World. *Microvelia* sp. was reported by Laird (1956: 166) from a treehole on Guadalcanal and one undescribed species of this genus occurs in treeholes in Ceylon (P. B. Karunaratne, personal communication to J. T. Polhemus 1981), the first veliids reported from small container habitats in the Old World. Yang & Kovac (1995) recorded species of *Baptista* and *Lathriovelina* (Microveliinae) from Bamboo internodes in West Malaysia.

The new veliid genus and species described here was discovered by the junior author in the Kakemega Forest in western Kenya, living in treeholes formed by adjoining root buttresses of *Ficus exasperata* Vahl. (see Biology notes below).

Cylicovelina gen. n.
(figs. 1–9)

Description

Size. – Macropterous form, elongate (fig. 1), length of males 4.88 to 5.22 mm, females 4.44 to 4.94 mm, general body characteristics and size not sexually di-

morphic, males and females very similar although males average slightly larger in size.

Colour. – Ground colour blackish brown, tinged with orange brown; anterior pronotal lobe brownish yellow on either side of median carina. Each hemelytron blackish brown, with five bright white marks, one basal, four distal, and one sordid yellowish stripe on inner basal cell (fig. 1). Apterous form without light markings.

Structural characters. – Apterous and macropterous forms known. Eyes globose, exserted, just reaching anterolateral pronotal angles, separated by about three times the width of an eye, appressed to anterior pronotal margin, with short ocular setae. Head declivant anteriorly, recessed into pronotum, posterior margin sloping caudo-dorsally, with usual three pairs of facial trichobothria; gular region very short, barely visible, rostral cavity closed posteriorly. Rostrum reaching to middle of mesosternum, segment I short, enclosed in rostral cavity, I and IV subequal in length and about three times longer than II, segment III about 8 times as long as II. Antennae slender, very long, almost 1/2 of body length (fig. 5). Pronotum raised medially, with weak median longitudinal carina, prominent at junction with anterior lobe, absent from latter except in apterous form; collar weakly formed, visible only dorso-laterally, terminating under eyes laterally; anterior and posterior lobes set off by a transverse row of large deep foveae, evanescent medially; both lobes set with short stiff erect dark setae; posterior lobe with numerous small foveae, humeri prominent, but less so in apterous form, broadly rounded posteriorly. Thoracic venter not diagnostic, with weakly formed tubercles on either side of mesosternal midline on posterior margin opposing an unmodified metasternum. Metasternal scent gland opening (omphalium) small but visible, marked by a

small tubercle; scent channels prominent, curving slightly anterad to base of metacetabulae.

Abdomen of macropters with prominent paired longitudinal carinae on tergite II (fig. 6), lacking in apterous form. Abdominal sternites set off from laterosternites by hair-free glabrous oval lacunae. Hemelytra and flight wings of macropters fully formed, reaching tip of abdomen, with four closed cells (fig. 1).

Legs stout, of moderate length; anterior femur thickly set beneath with dark setae, unmodified; anterior tibia of both sexes with a very narrow comb of closely set minute black denticles occupying almost entire tibial length in males (fig. 2), basal 7/8 in females; middle and hind femora of both sexes modified, tumid ventrally, set ventrally with short dark setae (figs. 3, 4); all tarsi long, claws moderately long, barely preapical; both up- and down curving arolia large, evident.

Male genital segments moderately large, protruding, not modified (figs. 7, 8); proctiger unmodified; parameres small, elongate, oval (fig. 9).

Female tergite VIII on same plane as VII, truncate posteriorly; first gonocoxae small, barely exposed, plate-like; tergite IX of both sexes rounded, protruding posteriorly.

Type-species. – *Cylicovelia kenyana* sp. n.

Remarks

Comparative notes. – The venation of both fore and hind wing is typical of the Microveliinae (see Andersen 1982, figs. 312, 313). We have compared *Cylicovelia* to all known microveliine genera, and find that it is closest to *Millotella* Poisson. In Andersen's (loc. cit.) key to the genera of Microveliinae, *Cylicovelia* keys to *Millotella* (couplet 7) but is clearly not this genus. Linnavuori (1977) provided the latest revision of African Microveliinae. In his key, *Cylicovelia* fails to resolve at couplet 5, because of the large size, yet short second antennal segment; ignoring size, at couplet 11 *Cylicovelia* is separated from *Millotella* because of the lack of stout black denticles ventrally on the mid-femur, and beyond that is clearly not closely allied to any of the three genera containing only small species, i. e. *Xiphoveloidea*, *Pseudovelina* and *Microvelia*. In comparison to *Millotella*, *Cylicovelia* has only a small distal nub on the fore tibia but with an extremely long tibial comb in both males and females (vs. a pronounced distal fore tibial pad and short comb restricted to males), the mid and hind femora are modified in both males and females (vs. only male mid femur in *Millotella*; *M. fontinalis* Linnavuori is not modified, but this species probably does not belong in *Millotella*), and males lack the bizarre abdominal modifications of *Millotella*. *Cylicovelia* is predominantly macropterous, rarely apterous (vs. predominantly apterous in

Millotella), the fore wing cells are of a different shape, and have a slightly different pattern of maculation.

Etymology. – The generic name *Cylicovelia* is derived from *kylicos* (Gr.), f., cup, referring to the container habitat, and *Velia*, the nominate genus of the family. Gender feminine.

Distribution. – Kenya.

Cylicovelia kenyana sp. n.
(figs. 1-9)

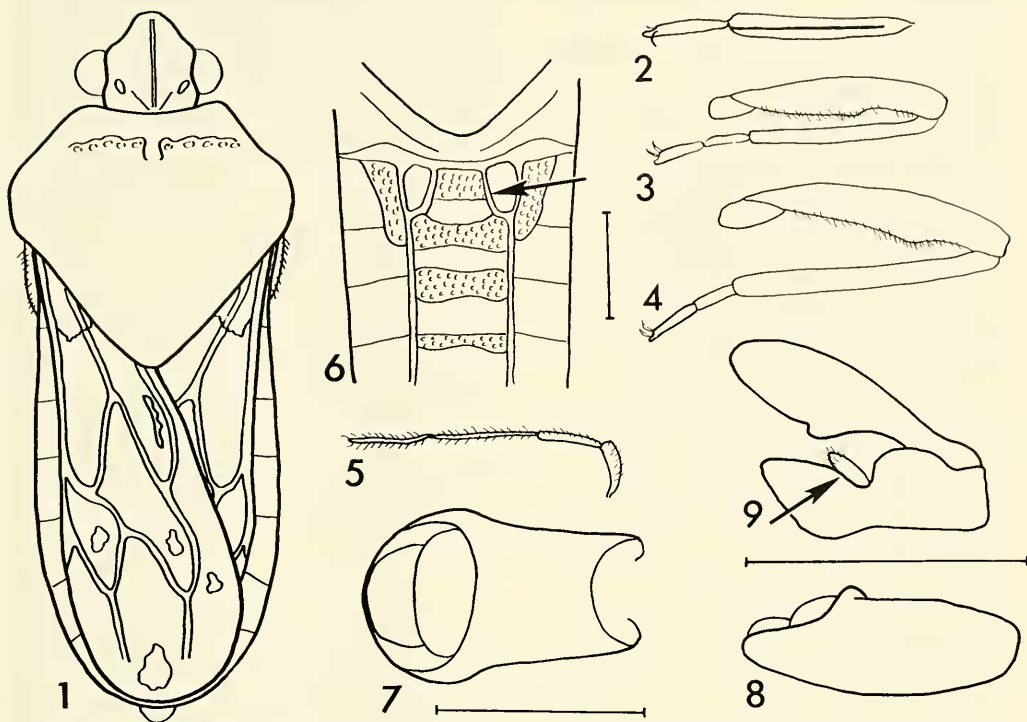
Type material. – Holotype, macropterous male, Kenya: Kakemega Forest, nr. Kakemega Forest Station, 0°14' N, 34°52' E, El. 1676m, treehole KKTH-AM1, height 1.7 m, 29.x.1993, R. Copeland (National Museum of Kenya). – Paratypes: (all macropterous unless noted, all collected by R. Copeland and assistants, all same data as holotype, all in J. T. Polhemus collection, R. S. Copeland collection, U. S. National Museum and National Museum of Kenya, except dates and height of treeholes as follows): KKTH-A, height 3.9 m; 6 females, 5.i.1993. KKTH-AM-1, height 1.7 m; 7 males, 10 females, 29.x.1993; 2 females, 13.x.1992; 1 female, 6.ix.1992; 3 females, 4.xii.1992. KK6TH-A, height 4.3 m; 1 male, 2 females, 6.ix.1992; 1 male, 19.i.1993; 1 female, 28.x.1993. KK6TH-C, height 3.8 m; 1 male, 1 female, 19.i.1993; 1 apterous male, 1.iii.1993. KK6TH-G, height 4.3 m; 1 male, 1 female, 28.viii.1993. KKTH-AV, height 5.3 m; 1 apterous female, 29.x.1993. KKTH-AB, height 0.3 m; 1 male, 3.iii.1993.

Description

Size. – Apterous male, length 4.66 mm ($n = 1$); width 1.78 mm ($n = 1$). Apterous female, length 4.66 mm ($n = 1$); width 1.83 mm ($n = 1$). Macropterous male, length 4.88 - 5.22 mm (mean = 5.02 mm, $n = 10$); width 1.78 - 2.05 mm (mean = 1.93 mm, $n = 10$). Macropterous female, length 4.44 - 4.94 mm (mean = 4.72 mm, $n = 10$); width 1.78 - 1.94 mm (mean = 1.86 mm, $n = 10$).

Colour. – Ground colour black, venter, tinged with brown. Head black, often tinged with orange brown, brown ventrally; rostrum luteous on basal three segments, piceous distally. Pronotum with anterior lobe broadly yellowish brown on either side of midline, forming two transverse bands; disc, collar blackish brown. Hemelytra blackish brown, veins lighter, set with bright white markings (fig. 1) and one sordid yellowish streak in inner basal cell. Legs, antennae luteous to brown; antennal segment III lighter, segment IV mostly luteous.

Structural characters. – Macropterous male: Head of moderate length, declivant anteriorly; length 0.61; width of eye/interocular space, 0.18/0.54. Pronotum length : width, 1.62 : 1.80. Abdominal sternites II-VI subequal in length, VII longer.



Figs. 1-9. *Cylicovelia kenyana* gen. n., sp. n. - 1, Macropterous female, dorsal habitus; 2-4, Male legs; 2, anterior tibia and tarsus, ventral view; 3, middle; 4, hind; 5, antennae; 6, abdominal tergites, macropterous male, showing depressed regions (textured) and carinae on tergite II (arrow); 7-9, male genitalia; 7, ventral view; 8, lateral view; 9, pygophore, proctiger, paramere (arrow). All scale bars = 1/2 mm.

Abdominal venter set with short appressed setae; ventrite VII unmodified, almost straight postero-medially and set with posteriorly directed fringe of long decumbent setae. Legs clothed with short setae, all femora beneath thickly set with very fine moderately long setae; antennae set with short setae and scattered longer setae. Legs unarmed, but slightly modified; all femora tumid on basal 2/3, middle and hind femora abruptly narrowing distally (figs. 3, 4); all tibia straight, anterior tibia with very long ventral comb (fig. 2).

Antennal formula I : II : III : IV; 0.40 : 0.50 : 0.83 : 0.61.

Proportions of legs as follows: Femur, tibia, tarsal 1, tarsal 2 of fore leg, 1.33 : 1.12 : 0.56 : 0.0; of middle leg, 1.66 : 1.44 : 0.36 : 0.40; of hind leg, 2.09 : 2.09 : 0.36 : 0.40.

Abdominal terminalia as shown in figs. 7-9; first genital segment medially slightly depressed. Paramere small, elongate oval (fig. 9).

Apterous male: Very similar to macropterous male

in most respects, but abdominal tergites lacking longitudinal carinae basally, and depressed areas restricted to tergal sutures. Pronotum with humeri less pronounced, median carinae more evident, posterior margin more rounded, feebly angulate, and slightly raised.

Macropterous female: Very similar to male in most respects; fore tibial comb terminating at distal 7/8.

Apterous female: Very similar to apterous male, but slightly more robust.

Remarks

Comparative notes. - See generic description.

Biological and collection notes. - All specimens were collected in treeholes west of the Kakemega Forest Station, mostly formed in the root buttresses of fig trees (*Ficus exasperata* Vahl). All but one tree-hole (KKTH-AV) are in trees in the stand of forest immediately abutting the Forest Station, and are within 500 m of it. KKTH-AV is located in a stand of forest

which is separated from the closer stand by a large area of open field. KKTH-AV is ca 1500 m from the forest sation.

Etymology. – The name *kenyana* refers to Kenya, the country of origin.

Distribution. – Kenya.

Biology and habitat notes

Cylicovelia kenyana was discovered in water-filled treeholes in the Kakemega Forest, western Kenya, by the junior author. All of the treeholes in which veliids were found were within 1500 meters of the Kakemega Forest Station, which is located at 0°14' N, 34°52' E, at an altitude of 1676 m above sea level. Kakemega Forest is the easternmost relic of African equatorial rain forest (Kokwaro 1988), and contains flora and fauna common to West as well as East Africa (Garnham et al. 1946). The first veliids were found in July of 1992 during a search of treeholes for larvae of the libellulid dragonfly, *Hadrothemis camarensis* (Kirby), a common inhabitant of treeholes in this forest (Copeland et al. 1996). The treehole was formed by adjoining root buttresses of *Ficus exasperata*. This type of hole is a pan as defined by Kitching (1971). Thereafter, searches of treeholes for veliids were done on an approximately monthly basis through July 1994. The water surface and inside bark of treeholes were searched with a flashlight, and veliids were captured by aspiration.

Veliids were collected from 9 of 40 different treeholes. Some treeholes were examined more than once, and veliids were found in 22 of the 196 examinations. Adults and immatures were found on the water surface and on the bark above the water. A total of 98 individuals were collected, with numbers in individual collections ranging from 1 to 40, median = 3 (five

adults and the immatures are not included in the type material). All treeholes that were positive for veliids, except one, were pans found in *F. exasperata*. The sole exception (KKTH-AB) was a pan formed where a *F. exasperata* grew against a *Trilepisium madagascariense* DC. It appeared that positive treeholes received insolation during the day, or at least were well lighted; veliids were not found in well shaded treeholes.

We examined the effect of treehole height and water volume on veliid distribution. For treeholes for which height was recorded, Veliidae were found in 9 (median = 3.78 m, range 0.3 to 5.3 m) and were absent from 27 (median = 1.35 m, range 0.25 to 6.4 m). Veliids were collected from 39% (n = 18) of treeholes higher than the overall median height (1.76 m) and from 11% (n = 18) of those lower than the median height. This difference was marginally significant ($\chi^2 = 3.70$, $p = 0.054$). Veliid distribution was independent of treehole water volume. For treeholes for which water volume was recorded, veliids were found in 9 (median water volume = 2.68 L; range 0.60 to 24.0 L) and were absent from 12 (median water volume = 2.58 L; range 0.50 to 6.0 L). Veliids were collected from 40% (n = 10) of holes with volumes greater than the overall median (2.68 L), and from 40% (n = 10) of holes with volumes below the overall median ($p = 1.0$; two-tailed Fisher's Exact Test).

The monthly distribution of positive treehole collections is shown in figure 10, along with monthly rainfall at the Kakemega Forest Station. Treehole samples positive for veliids were not distributed uniformly over the sampling period. Treeholes were more likely to contain veliids during the drier months from October to March (19 of 107 samples) than they were during the wet season from April to September (3 of 89 samples) ($\chi^2 = 10.09$, $p < 0.01$).

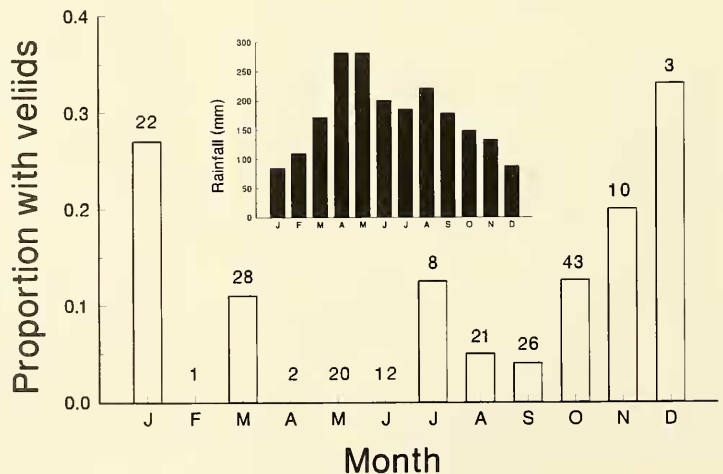


Fig. 10. Monthly proportions of treehole samples which contained veliids during the study period, July 1992-July 1994. The number of monthly samples is indicated above each bar. Fifty-two year mean monthly rainfall for the study site is shown in the inset (Kenya Meteorological Department).

The opposite was true for the distribution of treehole samples positive for larvae of the dragonfly, *H. camarensis*. Larvae of this species were significantly more likely to be found in treeholes during the wetter months than during the drier months of the year (Copeland et al. 1996). It is possible that these different temporal distributions are determined in part by biotic interactions between the two predators. Veliids may be important predators on culicid eggs and larvae (Frick 1949; Polhemus & Chapman 1979), and may have significant impact on the density of larval odonate prey in treeholes. Alternatively, veliid distribution may be influenced by predation by odonate larvae. Abiotic factors may also be important. Veliids may utilize other small bodies of water during the rainy season which become limited during the drier months, forcing a rainfall-related habitat switch into the more permanently wet treeholes. Odonates, on the other hand, may be limited to a range of treehole volumes that are most likely to exist during the rainy season. Odonate distribution was non-uniform with respect to treehole volume, and odonate-positive treeholes contained significantly greater water volumes than negative holes (Copeland et al. 1996).

It is interesting to note that in an intensive study of treehole mosquitoes Garnham et al. (1946) failed to report the presence of either veliids or odonates in treeholes in Kaimosi Forest which, at the time of their study, was contiguous with the Kakamega Forest. It is possible that treeholes of the type found in *F. exasperata* are specific habitats for both taxa. This tree species is near its maximum recorded altitude in the Kakamega Forest (Beentje 1994), and is very common around the Forest Station. It is not recorded by Garnham et al. (1946) as being one of the common species in the Kaimosi Forest, most of which is at a higher elevation than that of the Kakamega Forest. Recent searches in remnant stands of Kaimosi Forest failed to reveal the presence of *F. exasperata* there (M. Rotich, personal communication).

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